S/N 09/111,978 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Leonard H. Bieman	Examiner: Hoa Q. Pham
Serial No.:	09/111,978	Group Art Unit: 2877
Filed:	July 8, 1998	Docket: 139.045USR
Title:	SCANNING PHASE MEASURING METHOD AND SYSTEM FOR AN OBJECT AT A VISION STATION	

APPEAL BRIEF TO THE BOARD OF PATENT APPEALS AND INTERFERENCES OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

BOX AF
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This brief is presented in support of the Notice of Appeal filed on September 24, 2001, from the rejection of pending claims 30-85 of the above-identified patent reissue application. Appellant appeals the Final Office Action mailed June 22, 2001 and Advisory Action mailed September 4, 2001.

The Appeal Brief is **filed in triplicate** and accompanied by the requisite fee set forth in 37 C.F.R. § 1.17(c). Appellant respectfully requests reversal of the Examiner's rejection of pending claims 30-85.

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Real Party in Interest

The present patent is assigned to PPT Vision, Inc., a corporation organized and existing under the laws of the State of Minnesota, doing business at 12988 Valley View Road, Eden Prairie, MN 55344, in an assignment from Medar, Inc. recorded on June 30, 1998, Reel 9279 and Frames 0276-0279.

Related Appeals and Interferences

There are no other appeals or interferences known to Appellant which will have a bearing on the Board's decision in the present appeal.

Status of the Claims

Claims 1-85 are pending in this application. Claims 1-29 are allowed. Claims 30-85 are presently rejected and are the subject of the present appeal. Amendments to claim 30 and 60 were proposed, but were not entered by the Examiner, thus claims 30-85 including claim 30 and claim 60 as amended in the Amendment and Response mailed October 30, 2000 and response mailed February 28, 2001 are presented for this appeal.

Status of the Amendments

The claims are as amended in the Amendment and Response mailed October 30, 2000 and shown in the Response mailed February 28, 2001. Amendments to claim 30 and 60 were proposed in the Amendment and Response mailed August 22, 2001, but were not entered by the Examiner. Thus claims 30 and 60 as amended in the Amendment and Response mailed October 30, 2000 and shown in the Response mailed February 28, 2001 are presented for this appeal.

Summary of the Invention

The present application is directed to a system and method for obtaining height information by high speed, scanning phase measuring of an object at a vision station. As described in the Background Art section of the present patent (column 1 lines 17-34), other conventional systems

in the prior art:

> Height distribution of a surface can be obtained by projecting a light stripe pattern onto the surface and then reimaging the light pattern that appears on the surface. A powerful technique for extracting this information based on taking multiple images (3 or more) of the light pattern that appears on the surface while shifting the position (phase) of the projected light stripe pattern is referred to as phase shifting interferometry as disclosed in U.S. Pat. Nos. *4,641,972* and *4,212,073*.
>
> The multiple images are usually taken using a CCD video camera with the images being digitized and transferred to a computer where phase shift analysis, based on images being used as "buckets," converts the information to a contour map of the surface.
>
> The techniques used to obtain the multiple images are based on methods that keep the camera and viewed surface stationary with respect to each other and moving the projected pattern.

In contrast, the present invention that the Appellant describes, and claims in claims 1-13, is a method that includes maintaining the projector and detector in a fixed relationship and moving the object relative to the projector, detecting and measuring an electromagnetic radiation signal (e.g., an amount of light) at each of a plurality of detector elements, and computing phase values and amplitude values. As described in the Summary of the invention on column 2 lines 31-47:

> a method is provided for high speed scanning phase measuring of an object at a vision station to develop physical information associated with the object. The method includes the steps of projecting a pattern of imagable electromagnetic radiation with at least one projector and moving the object relative to the at least one projector at the vision station to scan the projected pattern of electromagnetic radiation across a surface of the object to generate an imagable electromagnetic radiation signal. The method also includes the steps of receiving the imagable electromagnetic radiation signal from the surface of the object with a detector having a plurality of separate detector elements and maintaining the at least one projector and the detector in fixed relation to each other. Finally, the method includes the steps of measuring an amount of radiant energy in the received electromagnetic radiation signal wherein **the detector elements produce images having different phases of the same scanned surface** based on the measurement and computing phase values and amplitude values for the different phases from the images. (Emphasis added.)

For example, in the case of three rows of detector elements, a "pixel" of the object is imaged onto a pixel of the first row, then the object is moved relative to the imager and projected light pattern (the imager and projected light pattern kept fixed to one another), the "pixel" of the object is imaged to a corresponding pixel of the second row, then the object is moved relative to the imager and projected light pattern and the "pixel" of the object is imaged to a corresponding pixel of the third row. This obtains three different phases of the same "pixel" of the scanned surface, thus allowing the height if the "pixel" to be calculated. Similarly, the other pixels in the rows of detector elements simultaneously obtain phase measurements of other portions of the scanned surface, providing a 3D measurement of the entire scanned surface.

Appellant also describes, and claims in claims 14-27, a system having a projector for projecting a pattern of imagable electromagnetic radiation, a detector, means for maintaining the projector and detector in substantially fixed relationship to one another, means for moving the object relative to the projector, and means for computing phase values and amplitude values.

Claims 1-29 are allowed.

Claims 30-85 were added in the reissue application. As the Applicant stated in the Applicant's **SUPPLEMENTAL DECLARATION OF INVENTOR AFTER AMENDMENT OF OCTOBER 30, 2000**:

> 10. After reading the opinion of outside patent counsel, I now believe that other patentably distinct independent claims are possible for claiming aspects of the invention. The existing independent claims 1 and 14 contain limitations or features which, if eliminated, result in patentably distinct claims. In particular, the requirement of moving at a substantially constant velocity and having substantially uniformly spaced detector elements are unnecessarily limiting and can be deleted without adding new matter.
>
> 11. New claim 30 is an independent claim and has eliminated the above-noted limitations present in claim 1, but contains other limitations that make it narrower than the original claim 1. New claim 42 is an independent claim and has eliminated the above-noted limitation present in claim 14, but contains other limitations that make it narrower than the original claim 1. Thus these claims avoid the prohibition against recapture of the same or broader scope of

cancelled claims (*Ball Corp. v. United States,* 221 U.S.P.Q. 289,295 (Fed. Cir. 1984)).

Issues Presented for Review

1. Whether claims 30, 42, 56, 60, and 72 are properly rejected under 35 U.S.C. § 251, as being an improper recapture of broadened subject matter surrendered in the application for the patent upon which the present reissue is based.

2. Whether claims 30, 32-33, 35, 36, 38-42, 44-46, 48, 52-58, 60, 62-63, 65-66, 69-72, 74-76, 78, and 82-85 were properly rejected under 35 U.S.C. 103(a) as being unpatentable over Shigeyama et al. (5,450,204) in view of Halioua et al. (4,641,972).

3. Whether claims 31, 34, 37, 43, 47, 49-51, 59, 61, 64, 67-68, 73, 77, and 79-81 were properly rejected under 35 U.S.C. 103(a) as being unpatentable over Shigeyama et al. (5,450,204) in view of Halioua et al. (4,641,972), and further in view of "PRIOR ART."

Grouping of the Claims

Claims 30-85 are the subject of this appeal. Each of claims 30-85 stands alone for the purposes of this appeal.

Argument

Rejection Under 35 U.S.C. § 251

1) The Applicable Law

35 U.S.C. § 251. Reissue of defective patents

Whenever any patent is, through error without any deceptive intention, deemed wholly or partly inoperative or invalid, by reason of a defective specification or drawing, or by reason of the patentee claiming more or less than he had a right to claim in the patent, the Commissioner shall, on the surrender of such patent and the payment of the fee required by law, reissue the patent for the invention disclosed in the original patent, and in accordance with a new and amended application, for the unexpired part of the term of the original patent. No new matter shall be introduced

into the application for reissue.

The Commissioner may issue several reissued patents for distinct and separate parts of the thing patented, upon demand of the applicant, and upon payment of the required fee for a reissue for each of such reissued patents.

The provisions of this title relating to applications for patent shall be applicable to applications for reissue of a patent, except that application for reissue may be made and sworn to by the assignee of the entire interest if the application does not seek to enlarge the scope of the claims of the original patent.

No reissued patent shall be granted enlarging the scope of the claims of the original patent unless applied for within two years from the grant of the original patent.

As noted in M.P.E.P. 1412.02 *Recapture of Canceled Subject Matter*,

> A reissue will not be granted to "recapture" claimed subject matter deliberately canceled in an application to obtain a patent. *In re Clement*, 131 F.3d 1464, 45 USPQ2d 1161 (Fed. Cir. 1997); *Ball Corp. v. United States*, 729 F.2d 1429, 1436, 221 U.S.P.Q. 289, 295 (Fed. Cir. 1989); *In re Wadlinger*, 496 F.2d 1200, 181 U.S.P.Q. 826 (C.C.P.A. 1974); *In re Richman*, 409 F.2d 269, 276, 161 U.S.P.Q. 359, 363-64 (C.C.P.A. 1969); *In re Willingham*, 282 F.2d 353, 127 U.S.P.Q. 211 (C.C.P.A. 1960). The Federal Circuit stated the following principles in *Clement*:
>
>> (1) if the reissue claim is as broad as or broader than the canceled or amended claim in all aspects, the recapture rule bars the claim; (2) if it is narrower in all aspects, the recapture rule does not apply, but other rejections are possible; (3) if the reissue claim is broader in some aspects, but narrower in others, then: (a) if the reissue claim is as broad as or broader in an aspect germane to a prior art rejection, but narrower in another aspect completely unrelated to the rejection, the recapture rule bars the claim; (b) if the reissue claim is narrower in an aspect germane to a prior art rejection, and broader in an aspect unrelated to the rejection, the recapture rule does not bar the claim, but other rejections are possible.
>
> [*In re Clement*,] 131 F.3d at 1469-70, 45 USPQ2d at 1165. See M.P.E.P. Section 1412.03 as to broadening claims.

Impermissible recapture occurs in a reissue where the claims in the reissue are of the

> same scope as, or are broader in scope than, claims deliberately canceled in an application to obtain a patent. **Where such claims also include some narrowing limitation not present in the claims deliberately canceled in the application, the examiner must determine whether that narrowing limitation has a material aspect to it. If the narrowing limitation has a material aspect to it, then there is no recapture.** However, if the narrowing limitation is incidental, mere verbiage, or would be inherent even if not recited (in view of the specification), then the claims should be rejected under 35 U.S.C. 251 using form paragraph 14.17.

(Bold emphasis added.)

As noted in *Hester Industries Inc. v. Stein, Inc,* 46 USPQ2d 1641, 1649-50 (Fed Cir 1998) col. 2:

> Finally, because the recapture rule may be avoided in some circumstances, we consider whether the reissue claims were materially narrowed in other respects. See, e.g., Mentor, 998 F.2d at 996, 27 U.S.P.Q.2D (BNA) at 1525 (" Reissue claims that are broader in certain respects and narrower in others may avoid the effect of the recapture rule."); Clement, 131 F.3d at 1470, 45 U.S.P.Q.2D (BNA) at 1165. For example, in Ball the recapture rule was avoided because the reissue claims were sufficiently narrowed (described by the court as "fundamental narrowness") despite the broadened aspects of the claims. 729 F.2d at 1438, 221 U.S.P.Q. (BNA) at 296. In the context of a surrender by way of argument, this principle, in appropriate cases, may operate to overcome the recapture rule when the reissue claims are materially narrower in other overlooked aspects of the invention. The purpose of this exception to the recapture rule is to allow the patentee to obtain through reissue a scope of protection to which he is rightfully entitled for such overlooked aspects.

Determining whether the statutory requirements of 35 U.S.C. § 251 have been met is a question of law. ... This legal conclusion is based on underlying findings of fact. ... An attorney's failure to appreciate the full scope of the invention qualifies as an error under section 251 and is correctable by reissue. *In re Wilder*, 736 F.2d 1516, 1519, 222 U.S.P.Q. 369, 370-71 (Fed. Cir. 1984). ... A reissue claim that deletes a limitation or element from the patent claims is broader in that limitation's aspect. ... Amending a claim "'by the inclusion of an additional limitation [has] exactly the same effect as if the claim as originally presented had been canceled and replaced by a new claim including that limitation." *In re Byers*, 43 C.C.P.A. 803, 230 F.2d 451, 455, 109

U.S.P.Q. 53, 55 (C.C.P.A. 1956). See *In re Clement*, 131 F.3d 1464, 1468, 45 U.S.P.Q.2D 1161, 1163-64 (Fed. Cir. 1997).

The proper focus is on the scope of the claims, not on the individual feature or element purportedly given up during prosecution of the original application. *Ball Corp. v. United States*, 29 F.2d 1429, 1437; 221 U.S.P.Q. 289, 295 (Fed. Cir. 1984), ***In re Richman*, 409 F.2d at 274-75, 161 U.S.P.Q. 359 at 362-63 ("We therefore find [no authority] for the proposition that a limitation added to a claim in obtaining its allowance cannot be broadened, under present statutory law, by reissue if the limitation turns out to be more restrictive than the prior art required. Certainly one might err without deceptive intention in adding a particular limitation where a less specific limitation regarding the same feature, or an added limitation relative to another element, would have been sufficient to render the claims patentable over the prior art.**" (emphasis added)). See also *In re Wadsworth and Wickenden*, 27 C.C.P.A. 735, 107 F.2d 596, 43 U.S.P.Q. 460, 464 (analysis turns on substantiality of similarity of reissue to canceled claims). In *Wadsworth*, the difference between the canceled claims and the reissue claims was in the preamble, and the reissue process was substantially identical to that of the canceled claims. However, in *Ball Corp. v. United States,* the reissue claims (which were upheld) were determined to be intermediate in scope -- broader than the claims of the original patent yet narrower than the canceled claims. *Ball* 221 U.S.P.Q. at 295.

2) The Section 251 Rejections

The Examiner rejected claims 30, 42, 56, 60 and 72 under 35 U.S.C. 251 for being an improper recapture of broadened claimed subject matter surrendered in the application for the patent upon which the present reissue application is based. Applicant respectfully traverses. This rejection is improper, and Applicant has cited case law supporting this position. Claims 30, 42, 56, 60 and 72 are substantially narrower in a manner directly material to the rejection AND are different than those claims surrendered in Applicant's amendment in the parent application, and distinguish from the art overcome in the parent application. The subject matter surrendered during prosecution of the parent application is that of the original claims. This subject matter is

not equivalent to all claims that do not have some specific limitation added by amendment. The scope of the present reissue claims is not the same or broader than the scope of the original claims that existed before amendment in the parent application. Rather, other different limitations, also directly material to the rejection, are included in claims 30, 42, 56, 60 and 72 , and because of these other material and sufficient limitations, the subject matter surrendered is NOT recaptured, and the recapture rule of Section 251 does not apply.

As noted in M.P.E.P. 1412.02 (3) (b) if the reissue claim is narrower in an aspect germane to a prior art rejection, and broader in an aspect unrelated to the rejection, the recapture rule does not bar the claim, but other rejections are possible. *In re Clement*, 131 F.3d at 1469-70, 45 USPQ2d at 1165. Because the reissue claims 30, 42, 56, 60 and 72 are narrower in an aspect germane to a prior art rejection. For example, claim 30 recites a method comprising:

> projecting a pattern of light;
> maintaining the projected pattern of light and the detector in a substantially fixed relation to each other;
> moving the object relative to the projected pattern of light so as to scan the projected pattern of light across an area of a surface of the object to generate an imagable light signal;
> imaging the imagable light signal onto the detector, the detector having a first, a second, and a third detector element, wherein the area of the surface of the object is imaged onto the first detector element at a first phase of the projected pattern of light, the area of the surface of the object is imaged onto the second detector element at a second phase of the projected pattern of light, and the area of the surface of the object is imaged onto the third detector element at a third phase of the projected pattern of light;
> measuring with the detector an amount of light from the area of the surface of the object to the first detector element at the first phase, to the second detector element at the second phase, and to the third detector element at the third phase; and
> computing dimensional information based on the measuring step.

which images the same area of the object onto the first detector at a first phase of the pattern, onto the second detector element at a second phase of the pattern, and the area of the surface of the object is imaged onto the third detector element at a third phase of the projected pattern of light. This is narrower and germane to the rejection because the prior art references kept the object and the detector in a fixed relationship and moved the projected light, thus the same area

of the object always imaged to the same detector at each different phase of the light as the light moved. Thus the reissue claims distinguish over the prior art in a manner germane to the rejection.

By analogy, if the original claim had limitations A, B, and C, and during the prosecution, Applicant added limitation D, then the "canceled claim" or subject matter surrendered is the claim to A, B, and C. The surrendered subject matter is not equal to any claim missing limitation D. The subject matter surrendered (i.e., A, B, C) is not recaptured by having reissue claims with limitations A, B, C, and E, particularly when the combination A, B, C, and E is not in the prior art, i.e., ABCE is narrower than ABC in a manner germane to the prior art rejection. ***In re Richman (citation below)***. The analysis turns on substantiality of similarity of the reissue claims to the canceled claims (i.e., ABCE vs. ABC), not on whether a particular limitation (D) is in all recaptured claims. *In re Wadsworth and Wickenden (citation below).*

The Examiner asserts that the limitations "at a substantially constant velocity," detector elements "which are substantially uniformly spaced" and "maintaining the . . . projector and the detector in a substantially fixed relation to each other" are omitted from the reissue claims 30, 42, 56, 60, and 72, and thus these claims improperly recapture subject matter surrendered in the parent application. Applicant respectfully traverses. The subject matter surrendered in the patent application was that of the original claims, i.e., the surrendered subject matter is the original claims, as if the original claims were cancelled and the amended claims were added. One does not look to any particular limitations added, but rather to whether the reissue claims are narrower than the original claims in a manner germane to the rejection. The Examiner originally cited *Hester Industries v Stein, In re Clement,* and *Ball Corp. v. United States*, but has not cited how this case law supports his position, nor refuted the case law cited by Applicant for the opposite position.

These added reissue claims have substantive limitations that were not in the original claims, and the claims are thus narrower in a manner germane to the rejection. These claims provide a combination that distinguishes over the cited references. Thus, the reissue claims do not recapture the original claims before being amended, i.e., the cancelled claims.

35 U.S.C. 251 bars broadening reissue filed later than two years after issuance of the patent. The present reissue application was filed July 8, 1998, within one year of the July 8, 1997 issue date of the parent, U.S. Patent No. 5,646,733, and is thus permitted to have broadened claims in the reissue. A prohibition of recapture is not a prohibition of broadening the claims, but rather is an issue of recapture of the surrendered subject matter, i.e., the original claims. Broadened claims are not prohibited.

Although it is well settled that a claim is broadened, so far as the question of right to reissue is concerned, if it is so changed as to bring within its scope any structure which was not within the scope of the original claim (in other words, a claim is broadened if it is broader in any respect than the original claim, even though it may be narrowed in other respects), the present reissue claims 30, 42, 56, 60, and 72 include other limitations that clearly distinguish over the cited art in a similar manner as the omitted limitations. A patentee may obtain a reissue claim that varies materially from a claim originally surrendered even though it omits a limitation added to obtain issuance. *Ball Corp. v. United States, supra*. Claims are not within the recapture doctrine if they differ materially from the abandoned claims. In the present case, the reissue claims clearly are not materially similar to the claims originally surrendered, even though they omit limitations added to obtain issuance of the patent.

In the original case, keeping the projector and imager detector in a substantially fixed relation to each other, having detector elements which are substantially uniformly spaced, and moving the object relative to the projector at a substantially constant velocity provided that the same single area of the surface would be imaged at each successive detector element at different successive phases. However, having non-uniformly spaced elements is also not in the prior art, and moving at a non-constant velocity is also not in the prior art. Thus, these limitations are not required to distinguish over the prior art.

The Kuchel reference (5,135,308, cited in the parent application) described a projector having a movable grid, and which provided two different projection patterns that alternated in time and/or wavelength (color) such that height information could be derived. The imager and the object of Kuchel were **not** moved relative to one another to obtain different phase readings;

rather the two patterns and/or the moving projection grid provided phase differences that could be detected or calculated.

The Bullock reference (5,488,478, cited in the parent application) operated on an entirely different principle, i.e., one or more laser beams were scanned in a spaced-apart transverse direction across a moving sheet of steel (i.e., perpendicular to the sheet motion), and a linear detector oriented in a longitudinal direction would detect the longitudinal displacement of the line caused by height changes. In the projector, three moving galvanometer mirrors (galvanometer scanners of a rotating or oscillating mirror system) scan the laser beam spot in a transverse direction (generally perpendicular to the direction of motion of the sheet) and at a non-perpendicular angle of incidence, so as the height of the sheet changes, there is a longitudinal shift in the spot (i.e., it moves parallel to the direction of sheet motion when height varies). However, the Bullock laser lines are spaced apart, and it is the scanned laser line that is measured (i.e., the displacement of its center by determining which pixel it falls on), rather than the phase between lines (i.e., measuring the intensity at one pixel). I.e., the laser spot of one line would move to a different pixel (of, e.g., the 2048 pixels) of the SAME linear detector element. Thus, phase of the projection pattern is not measured. Rather the linear displacement of each line along the linear detector is measured. Further, a single spot area of the moving strip of steel moves along pixels of a single detector element, never across two or three or more. As noted on column 3 lines 25-33:

> "Images of the light patterns received on the receiving surface 12 are shown at 4a, 4b and 4c. The linear light sensitive arrays 14 are typically conventional charge coupled devices and the positions of each light pattern 4a, 4b, 4c, is determined by reference to the pixels of the array 14 which are activated by the respective light pattern. Each linear array 14 is separate from the arrays of the other cameras and the outputs from the several linear arrays are processed in parallel using electronic hardware."

In contrast, while reissue claim 30 omits certain limitations of the amended claim of the original application, it is also narrower than the cancelled original claim in a manner germane to the rejection by the fact of other limitations, and distinguishes from the cited references by those limitations. Thus, since claim 30 does not recite a projector, the steps of: "projecting a pattern of light; and maintaining **the projected pattern of light** and the detector in a substantially fixed

relation to each other" are appropriate and are sufficient to distinguish over the cited art. Further, while claim 1 recites "moving the object relative to the . . . projector at a substantially constant velocity . . . ; receiving the . . . signal . . . with a detector having a plurality of separate detector elements which are substantially uniformly spaced," the present reissue claim recites "imaging the imagable light signal onto the detector, the detector having a first, a second, and a third detector element, wherein the area of the surface of the object is imaged onto the first detector element at a first phase of the projected pattern of light, the area of the surface of the object is imaged onto the second detector element at a second phase of the projected pattern of light, and the area of the surface of the object is imaged onto the third detector element at a third phase of the projected pattern of light." Thus the invention of claim 30 obtains three images at three different phases of the same area of the surface, as the area of the surface is moved to image to the first, second and third detector elements. Thus, reissue claim 30 appears in condition for allowance, and such action is respectfully requested.

Regarding claims 42, 56, 60 and 72, each of these claims also includes limitations that distinguish the claim as a whole over all the cited references. Thus, these claims also appear in condition for allowance, and such action is respectfully requested.

The recapture rule is based on equitable principles. The claims of the reissue application are intermediate in scope: broader that the issued claims of the parent patent, but sufficiently narrower than those canceled from the original application so as to clearly distinguish from all the cited references. Neither the canceled claims (i.e., the original claims before amendment) nor their equivalent are recaptured.

Applicant has provided a careful analysis of the case law and has shown that the reissue claims are not an improper recapture of canceled subject matter. Appellant respectfully request reversal of the rejections of claims 30, 42, 56, 60, and 72.

Rejection Under 35 U.S.C. § 103(a)

1) The Applicable Law for Rejections Under 35 U.S.C. § 103

According to *M.P.E.P.* § 2141, which cites *Hodosh v. Block Drug Co., Inc.*, 786 F.2d 1136,

1143 n.5, 229 U.S.P.Q. 182, 187 n.5 (Fed. Cir. 1986), the following tenets of patent law must be adhered to when applying 35 U.S.C. § 103. First, the claimed invention must be considered as a whole. Second, the references must be considered as a whole and must suggest the desirability and thus the obviousness of making the combination. Third, the references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention. Fourth, obviousness is determined using a reasonable expectation of success standard. Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. *M.P.E.P.* § 2141 (citing *Graham v. John Deere*, 383 U.S. 1, 148 USPQ 459 (1966)).

The Examiner has the burden under 35 U.S.C. § 103 to establish a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *M.P.E.P.* § 2142 (citing *In re Vaeck*, 947 F.2d, 488, 20 USPQ2d 1438 (Fed. Cir. 1991)).

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *M.P.E.P.* § 2142 (citing *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991)). The references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references. *M.P.E.P.* § 2142 (citing *Ex parte Clapp*, 227 USPQ 972, 973 (Bd. Pat. App. & Inter. 1985)). In considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but also the inferences which one skilled in the art would reasonably be expected to draw therefrom. *M.P.E.P.* § 2144.01 (citing *In re Preda*, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968)). However, if the proposed modification would render the prior

art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *M.P.E.P.* § 2143.01 (citing *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)).

In order to take into account the inferences which one skilled in the art would reasonably make, the examiner must ascertain what would have been obvious to one of ordinary skill in the art at the time the invention was made, and not to the inventor, a judge, a layman, those skilled in remote arts, or to geniuses in the art at hand. *M.P.E.P.* § 2141.03 (citing *Environmental Designs, Ltd. v. Union Oil Co*, 713 F.2d 693, 218 USPQ 865 (Fed. Cir. 1983), *cert. denied*, 464 U.S. 1043 (1984)).

> The examiner must step backward in time and into the shoes worn by the hypothetical "person of ordinary skill in the art" when the invention was unknown and just before it was made. In view of all factual information, the examiner must then make a determination whether the claimed invention "as a whole" would have been obvious at that time to that person. Knowledge of applicant's disclosure must be put aside in reaching this determination, yet kept in mind in order to determine the "differences," conduct the search and evaluate the "subject matter as a whole" of the invention. The tendency to resort to "hindsight" based upon applicant's disclosure is often difficult to avoid due to the very nature of the examination process. However, impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the facts gleaned from the prior art.

M.P.E.P. § 2141.03.

2) The 35 U.S.C. §103 Rejection of Claims

Claims 30, 32-33, 35, 36, 38-42, 44-46, 48, 52-58, 60, 62-63, 65-66, 69-72, 74-76, 78, and 82-85 were rejected under 35 U.S.C. 103(a) as being unpatentable over Shigeyama et al. (5,450,204) in view of Halioua et al. (4,641,972). Applicant again respectfully traverses the rejection. Applicant submits that, contrary to the assertion of the Examiner, the patent of Shigeyama et al. does not "maintain[] the projected pattern of light and the detector in a substantially fixed relation to each other."

Shigeyama MOVES the light pattern relative to the detector between images.

That's what the LCD does. See Figure 5(a)-5(d). Thus the claims of the present invention are not obvious, since the reference does not teach nor suggest the claimed invention.

Shigeyama et al. used the LCD pattern generator to sequentially move the projected pattern of light (see Figures 5A-5D)

> (see column 4 line 44-55: "Referring further to FIGS. 5(a) to 5(d), there is shown a method of driving the liquid crystal element 24. In this driving method, the electrode portions of the strip electrode 41 are driven so as to be shifted by 1/4 pitch, thus producing light patterns varying in four phases. More specifically, as shown in FIGS. 5(a), 5(b), 5(c) and 5(d), the liquid crystal element 24 is driven so that each set of two electrode portions of the strip electrodes 41 are successively turned ON to transmit light. The periods of the shift, directions and the number of division of the strip electrodes, etc. may be set as desired according to the driving circuit.")

This merely replaces a moving physical pattern grating in the projector with an electronically controlled LCD having movable nematic crystals that are moved by electric fields to generate moving patterns. Further, Shigeyama et al. does not "mov[e] the object relative to the projected pattern of light so as to **scan** the projected pattern of light across a surface of the object to generate an imagable light signal," but rather the object remains at a fixed location while it uses the LCD to scan the pattern, and then moves the circuit board to another fixed location to again scan using the moving pattern generated by the LCD. All measurements are made in a fixed location. When the imaging for an area is complete, the object is moved to a new fixed area to be measured. This movement is thus due to the small field of view, and not to obtain different phases of the pattern of light.

Claims 30 and 60 require that the object is moved relative to <u>both the projected pattern of light and the detector,</u> since the pattern of light is maintained in a fixed relationship to the detector and the object is moved relative to the projected pattern of light so as to scan the projected pattern of light across the object. Claims 42, 56, and 72 all recited that the object and projector moved relative to one another to scan the light pattern.

Shigeyama scans the projected pattern of light (using the LCDs) while keeping the object and detector and the projector all in a fixed relationship. Thus the claims of the

present invention are not obvious. Thus, claims 30, 42, 56, 60, and 71, and all their dependent claims appear allowable, and such action is respectfully requested.

The Examiner admits that Shigeyama et al. does not teach "the detector having a first, a second, and a third detector element, wherein the surface of the object is imaged onto the first detector element at a first phase of the projected pattern of light, the surface of the object is imaged onto the second detector element at a second phase of the projected pattern of light, and the surface of the object is imaged onto the third detector element at a third phase of the projected pattern of light." That is because Shigeyama images the same area of the object to the same detector element for each reading, and instead moves the pattern of light (by moving the liquid crystals in the LCD device of the projector) to obtain different phases. If and when Shigeyama moves the projector, it is to a different and unrelated portion of the object or to a different object, and thus images from different positions cannot be combined to get height information. By Shigeyama's moving the pattern of light relative to the detector by changing the LCD pattern over time, this reference teaches away from the present invention.

Applicant submits that, contrary to the assertion of the Examiner, Halioua et al. also does not provide such a teaching. Rather, Halioua et al. again provides a moving or scanned sinusoidal phase pattern of light (the pattern moves relative to the detector: see Figure 1–the projector has a phase shifter, and Figure 7, the grating G is shown moving by the arrow), and with any particular detector (e.g., D_c of FIG. 7), records three images of a point D (the same point is imaged to the same detector, but the light phase moves or changes) of the object with a phase increment of 120 degrees following each recording. See Column 3 lines 38-41 and 49-53 (emphasis added):

> "A sinusoidal intensity distribution can be projected on the surface to be profiled, e.g. by generating **an interference pattern between two coherent plane wavefronts or by projecting an image of a grating with sinusoidal transmission function distribution illuminated by an incoherent light source**. FIG. 2 illustrates an embodiment of the projection system and phase shifter 110 (of FIG. 1), which comprises a laser illuminated shearing polarization interferometer. The linearly polarized output beam from the laser 111 is spatially filtered by filter 112, which includes lens 113 and pinhole 114, and then sheared by a Wollaston prism W. The phase modulator includes a combination of a

> quarter wave plate Q and a rotatable polarized P. By rotating the polarizer, the sinusoidal intensity distribution of the interference pattern can be modulated. **A 180° rotation of the polarizer corresponds to a 2 pi phase modulation and this permits precise phase shifts. It will be understood that other types of phase shifters, for example polarization dependent phase shifters such as electro-optic modulators, may also be used in this system. The fringe period can also be easily changed by an axial translation of the Wollaston prism W.** A collimating lens L is used to conserve light and simplify the optical geometry."

Thus, the projector is moved (rotating the polarizer or axially translating the Wollaston prism) to phase shift (move) the light pattern relative to the imager. The movement of the pattern and projector is apparent even from the sections sited in the Office Action column 4 lines 10-13 and column 4 line 62- column 5 line 4:

> "A_n is one of the detectors in the array, located at the image plane and is used to measure the intensity at C on the reference plane and at D on the object. "

> "By recording N frames of intensity data, the phase seen by each detector in the array can be computed, both for the reference plane and the object surface. Based on the continuity of the phase function, starting from a reference location with zero phase, the integer M of Eq. (6) can also be determined by monitoring the computed phases between two adjacent detectors and identifying sharp phase discontinuities which result from the 2 pi transitions. "

See also column 7 lines 20-33 and column 8 lines 26-28:

> "Surface profile measurements were made, using the system of FIGS. 1, 2, on a general test object (a half cylinder with two sections having different radii), mounted on a reference plane and illuminated with a sinusoidally varying beam intensity as previously described. In order to generate a phase variation in both the horizontal as well as vertical directions an inclined set of fringes were projected on the object. FIG. 5 shows the deformed grating as seen by the detector array. Three images each were recorded for the reference plane and the object surface, with a phase increment of 120° of the projected fringe pattern following each recording, and processing was performed as previously described."
>
> "A particular detector such as Dc can measure the phase phi c at a point C on the reference plane as well as phi D on the point D of the object."

The three frames (see column 6 line 12-21) collected are of the object (which ***is not moved*** relative to the detector array) at three different phases of the light pattern (which ***is moved*** relative to the image detector array).

Thus, neither reference provides the limitations that the Office Action asserts that they do and they do not render the claimed invention obvious, and thus claims 30, 32-33, 35, 36, 38-42, 44-46, 48, 52-58, 60, 62-63, 65-66, 69-72, 74-76, 78, and 82-85 appear to be in condition for allowance, and such action is respectfully requested.

Regarding claims 39-41, 52-54, 69-71 and 82-84, the Examiner asserts that it would have been obvious to one of skill in the art to add a second projected pattern of light. The Examiner asserts a rationale that using an extra projected light would provide better performance. Kuchel, cited by the Examiner, uses two patterns of light to achieve basic Moire functionality, and thus the Examiner has not provided any motivation or explanation of how adding a second projector into the invention of Shigeyama would or could obtain better performance. Applicant respectfully traverses the rejection and its unsupported rationale. The Examiner has the burden under 35 U.S.C. § 103 to establish a *prima facie* case of obviousness. *In re Fine*, 837 F.2d 1071, 1074, 5 USPQ2d 1596, 1598 (Fed. Cir. 1988). To do that, the Examiner must show that some objective teaching in the prior art or some knowledge generally available to one of ordinary skill in the art would lead an individual to combine the relevant teaching of the references. *Id.* Further, the Examiner must avoid hindsight and must not use the teaching of the application as a template to reconstruct the invention.

In response to Applicants request under M.P.E.P. 2144.03, the Examiner has proffered the Kuchel reference. Kuchel does not support the Examiner's assertion. Kuchel projects barred patterns sequentially (time division multiplexing) and these are sequentially and individually recorded by its camera. The computer computes the differences. Thus, Kuchel uses multiple projections to obtain phase relationship ψ_1 ψ_2 and their difference $\Delta\psi$. Attempting to do any such combination of two single-phase projections combined into the invention of Shigeyama is unexplained and lacks enablement and workability.

Applicant submits that the Examiner has failed his burden to establish a *prima facie* case

of obviousness at the time of the invention of any of the limitations of claims 39-41, 52-54, 69-71 and 82-84, and that these claims appear to be in condition for allowance.

Claims 31, 34, 37, 43, 47, 79-51, 59, 61, 63, 67-68, 73, 77, 79-81 were rejected under 35 U.S.C. 103(a) as being unpatentable over Shigeyama et al. and Halioua et al. as applied to claims 30, 32-33, 35, 36, 38-42, 44-46, 48, 52-58, 60, 62-63, 65-66, 69-72, 74-76, 78, and 82-85 above, and further in view of PRIOR ART. Applicant respectfully traverses the rejection. As described above, those various base claims appear to be allowable over Shigeyama et al. and Halioua et al. as applied to those claims, and as described above, Shigeyama et al. and Halioua et al. do not apply to corresponding limitations of claims 31, 34, 37, 43, 47, 79-51, 59, 61, 63, 67-68, 73, 77, and 79-81. PRIOR ART is a trilinear array camera 24, for example, the Kodak CCD chip model KLI-2103 which has 3 rows of detector or sensing elements 25 each having 2098 CCD sensing elements per row. The Examiner admits that Shigeyama et al. and Halioua et al. do not teach a tri-linear array. The Examiner asserts a rationale that such trilinear camera would detect first second and third phase simultaneously and therefore speed measurements.

Applicant respectfully disagrees. Both Shigeyama et al. and Halioua et al. scan the projected phases but keep the camera and object fixed (not moving) relative to one another while obtaining the different phase measurements. Thus, each uses an array detector, with each pixel in an X-Y grid receiving an image from a single area of the object being measured. At successive times, successive images are recorded, each at a different phase due to the scanning of the phase pattern between image times. One each of these successive recorded phase images, the same area is imaged to the same pixel, however each at a different phase of the scanned pattern. If one were to replace the imaging devices of Shigeyama et al. and Halioua et al. with a trilinear array, one would obtain only successive trilinear images of three stripes of the object, rather than the entire object (each of the three imager stripes receives a different stripe of the object, rather than simultaneously receiving three phase measurements of a single stripe of the object as the Examiner asserts). Recording only three lines instead of an entire array is SLOWER, not faster. Further, multiple 3-line images would need to be stitched together, a further complication not

suggested, enabled or explained.

Appellant respectfully request reversal of the rejections of claims 30-85. Applicant respectfully submits that the claims are in condition for allowance and notification to that effect is earnestly requested.

Conclusion

It is respectfully submitted that the cited art neither anticipates or renders the claimed invention obvious and that therefore the claimed invention does patentably distinguish over the cited art. Further, claims 30-85 avoid the prohibition against recapture of claims of the same or broader scope as canceled claims. Claims 1-29 are allowed. It is respectfully submitted that in view of the arguments presented claims 30-85 should also be allowed. Reversal of the Examiner's rejections of claims 30-85 is respectfully requested.

The Examiner is invited to telephone Applicant's attorney (612-373-6949) to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Box AF, Commissioner for Patents, Washington, D.C. 20231, on this 29th day of April, 2002.

Charles A. Lemaire
Name

Charles A. Lemaire
Signature

Appendix A - The Claims Under Appeal

1. [Amended Once] A method for high speed, scanning phase measuring of an object at a vision station to develop physical information associated with the object, the method comprising the steps of:

projecting a pattern of imagable electromagnetic radiation with at least one projector;

moving the object relative to the at least one projector at a substantially constant velocity at the vision station so as to scan the projected pattern of electromagnetic radiation across a surface of the object to generate an imagable electromagnetic radiation signal;

receiving the imagable electromagnetic radiation signal from the surface of the object with a detector having a plurality of separate detector elements which are substantially uniformly spaced;

maintaining the at least one projector <u>and the pattern of imagable electromagnetic radiation</u> and the detector in a substantially fixed relation to each other;

measuring an amount of radiant energy in the received electromagnetic radiation signal with the detector wherein each of the detector elements produce an image having a different phase of the same scanned surface based on the measurement; and

computing phase values and amplitude values for the different phases from the multiple images.

2. The method as claimed in claim 1 wherein the physical information is dimensional information and the imagable electromagnetic radiation is light.

3. The method as claimed in claim 2 wherein the detector has an optical axis and wherein the step of moving is performed in a direction substantially parallel to the optical axis and wherein the projected pattern of light is a stripe of lines.

4. The method as claimed in claim 2 further comprising the step of determining height of the surface of the object based on the phase and amplitude values.

5. The method as claimed in claim 1 wherein the physical information is polarization information, the imagable electromagnetic radiation is polarized, a response of the detector elements is polarization sensitive and wherein the images are based on polarization from the surface.

6. The method as claimed in claim 1 wherein the plurality of detector elements are uniformly spaced and wherein the step of moving is performed uniformly and continuously.

7. The method as claimed in claim 1 wherein the step of computing includes the step of registering the images.

8. The method as claimed in claim 1 wherein the detector elements are elongated in a direction parallel to a detector axis of the detector, and wherein the detector also has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the detector and optical axes.

9. The method as claimed in claim 8 wherein the detector is a multi-linear array camera.

10. The method as claimed in claim 8 wherein each detector element is a row of CCD sensing elements extending substantially parallel to the detector axis and wherein the step of moving is performed in a direction substantially perpendicular to the rows of the CCD sensing elements.

11. The method as claimed in claim 1 wherein the step of projecting is performed with two projectors.

12. The method as claimed in claim 11 wherein the step of moving includes the step of cycling the object relative to the two projectors wherein the two projectors alternately project the pattern of imagable electromagnetic radiation.

13. The method as claimed in claim 11 wherein the two projectors alternately project the pattern of imagable electromagnetic radiation during consecutive scans of the projected pattern of imagable electromagnetic radiation.

14. [Amended Once] A system for high speed, scanning phase measuring of an object at a vision station to develop physical information associated with the object, the system including:

at least one projector for projecting a pattern of imagable electromagnetic radiation;

means for moving the object relative to the at least one projector at the vision station at a substantially constant velocity so as to scan the projected pattern of imagable electromagnetic radiation across a surface of the object to generate an imagable electromagnetic radiation signal;

a detector for receiving the imagable electromagnetic radiation signal from the surface of the object and having a plurality of separate detector elements which are substantially uniformly spaced for measuring an amount of radiant energy in the imagable electromagnetic radiation signal wherein each of the detector elements produces an image having a different phase of the same scanned surface based on the measurement;

means for maintaining the at least one projector <u>and the pattern of imagable electromagnetic radiation</u> and the detector in a substantially fixed relation to each other; and

means for computing phase values and amplitude values for the different phases from the images.

15. [Amended Once] The [method] <u>system</u> as claimed in claim 14 wherein the physical information is dimensional information and the imagable electromagnetic radiation is light.

16. The system as claimed in claim 15 wherein the detector has an optical component for

receiving the reflected light signal, the optical component having an optical axis and wherein the means for moving moves the object relative to the at least one projector in a direction substantially parallel to the optical axis and wherein the projected pattern of light is a stripe of lines.

17. The system as claimed in claim 15 further comprising means for determining height of the surface of the object based on the phase and amplitude values.

18. [Amended Once] The [method] <u>system</u> as claimed in claim 14 wherein the physical information is polarization information, the imagable electromagnetic radiation is polarized, a response of the detector elements is polarization sensitive and wherein the images are based on polarization from the surface.

19. The system as claimed in claim 14 wherein the plurality of detector elements are uniformly spaced and wherein the means for moving moves the object relative to the at least one projector uniformly and continuously.

20. The system as claimed in claim 14 wherein the means for computing includes means for registering the images.

21. The system as claimed in claim 14 wherein the detector elements are elongated in a direction parallel to a detector axis of the detector and wherein the detector also has an optical component having an optical axis and wherein the means for moving moves the object relative to the at least one projector in a direction substantially perpendicular to the detector and optical axes.

22. The system as claimed in claim 21 wherein the detector is a multi-linear array camera.

23. The system as claimed in claim 21 wherein each detector element is a row of CCD sensing elements extending substantially parallel to the detector axis and wherein the means for moving moves the object relative to the detector in a direction substantially perpendicular to the rows of the CCD sensing elements.

24. The system as claimed in claim 14 further comprising two projectors, the two projectors projecting the pattern of imagable electromagnetic radiation.

25. The system as claimed in claim 24 wherein the means for moving cycles the object relative to the two projectors wherein the two projectors alternately project the pattern of imagable electromagnetic radiation during consecutive cycles.

26. [Amended Once] The system as claimed in claim 24 wherein [imagable] the two projectors alternately project the pattern of electromagnetic radiation during consecutive scans of the projected pattern of imagable electromagnetic radiation.

27. The system as claimed in claim 14 wherein the at least one projector and the detector at least partially define an optical head.

<u>28. The method as claimed in claim 2 wherein the detector has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light is a stripe of lines.</u>

<u>29. The system as claimed in claim 15 wherein the detector has an optical component for receiving the reflected light signal, the optical component having an optical axis and wherein the means for moving moves the object relative to the at least one projector in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light is a stripe of lines.</u>

30. [Amended Once] A method for high-speed scanning measurement of an object at a vision station, the vision station having a detector, in order to determine dimensional information associated with the object, the method comprising the steps of:

projecting a pattern of light;

maintaining the projected pattern of light and the detector in a substantially fixed relation to each other;

moving the object relative to the projected pattern of light so as to scan the projected pattern of light across an area of a surface of the object to generate an imagable light signal;

imaging the imagable light signal onto the detector, the detector having a first, a second, and a third detector element, wherein the area of the surface of the object is imaged onto the first detector element at a first phase of the projected pattern of light, the area of the surface of the object is imaged onto the second detector element at a second phase of the projected pattern of light, and the area of the surface of the object is imaged onto the third detector element at a third phase of the projected pattern of light;

measuring with the detector an amount of light from the area of the surface of the object to the first detector element at the first phase, to the second detector element at the second phase, and to the third detector element at the third phase; and

computing dimensional information based on the measuring step.

31. The method according to claim 30, wherein each one of the first, second, and third detector element includes a plurality of detector pixel elements.

32. The method according to claim 30, wherein the detector has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light includes a stripe of lines.

33. [Amended Twice] The method according to claim 30, wherein the measurement step obtains an amplitude value at each one of the three phases, and further comprising the step of

determining a height of the area of the surface of the object based on phase and amplitude values from the measuring step.

34. The method according to claim 30, wherein a spacing between the first and second detector element is substantially equal to a corresponding spacing between the second and the third detector element, and wherein the step of moving is performed at a substantially uniform velocity.

35. The method according to claim 30, wherein the step of computing includes the step of registering the images.

36. The method according to claim 30, wherein the detector elements are elongated in a direction parallel to a detector axis of the detector, and wherein the detector also has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the detector axis and substantially perpendicular to the optical axis.

37. The method according to claim 36, wherein the detector includes a tri-linear array camera.

38. The method according to claim 30, wherein each detector element includes a row of CCD sensing elements extending substantially parallel to the detector axis and wherein the step of moving is performed in a direction substantially perpendicular to the rows of the CCD sensing elements.

39. [Amended Once] The method according to claim 30, wherein the step of projecting includes the step of projecting with two projected patterns of light.

40. The method according to claim 39, wherein the step of moving includes the step of cycling the object relative to the two projected patterns of light, and wherein the two projected

patterns of light are alternately projected.

41. The method according to claim 39, wherein the two projected patterns of light are alternately projected during consecutive scans.

42. [Amended Once] A system for high-speed scanning measurement of an object at a vision station in order to determine dimensional information associated with the object, the system including:

a first projector that projects a pattern of light, the pattern of light having a first, a second, and a third phase;

a drive that moves the object relative to the first projector at the vision station so as to scan the projected pattern of light across an area of a surface of the object to generate an object light signal;

a detector having a first, a second, and a third detector element that each generate an image value representing an amount of light in the object light signal from the area of the scanned surface of the object, wherein the first detector element produces a first image value based on an image of the area of the scanned surface at the first phase of the projected pattern of light, the second detector element produces a second image value based on an image of the area of the scanned surface at the second phase, and the third detector element produces a third image value based on an image of the area of the scanned surface at the third phase, and wherein the detector is maintained in a substantially fixed relation to the first projector and to the pattern of light; and

a computational element coupled to the detector that computes the dimensional information associated with the object based on the first, second, and third image values.

43. The system according to claim 42, wherein each detector element includes a plurality of detector pixels elements.

44. The system according to claim 42, wherein the detector has an optical element for receiving the object light signal, the optical element having an optical axis, and wherein the drive moves the object relative to the first projector in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light includes a stripe of lines.

45. [Amended Once] The system according to claim 42, wherein the computational element computes a height of the area of the surface of the object based on the first, second, and third image values.

46. The system according to claim 42, wherein the pattern of light is polarized and a response of the detector elements is polarization sensitive.

47. The system according to claim 42, wherein a spacing between the first and second detector element is substantially equal to a corresponding spacing between the second and the third detector element, and wherein the step of moving is performed at a substantially uniform velocity.

48. The system according to claim 42, wherein the computational element registers the images.

49. The system according to claim 42, wherein:

the detector elements are elongated in a direction parallel to a detector axis of the detector;

the detector also has an optical element having an optical axis; and

the drive moves the object relative to the first projector in a direction substantially perpendicular to the detector axis and substantially perpendicular to the optical axis.

50. The system according to claim 49, wherein the detector includes a tri-linear array camera.

51. The system according to claim 42, wherein:

each detector element includes a row of CCD sensing elements extending substantially parallel to the detector axis, and

the drive moves the object relative to the detector in a direction substantially perpendicular to the rows of the CCD sensing elements.

52. The system according to claim 42, further comprising a second projector, the first and second projectors projecting the pattern of light.

53. The system according to claim 52, wherein the drive cycles the object relative to the two projectors wherein the two projectors alternately project the pattern of light during consecutive cycles.

54. The system according to claim 52, wherein the two projectors alternately project the pattern of light during consecutive scans of the projected pattern of light.

55. The system according to claim 42, wherein the projector and the detector define at least part of an optical head.

56. [Amended Once] A system for high-speed scanning height measurement of an object at a vision station in order to determine dimensional information associated with the object, the system comprising:

an optical head, the optical head including:

a projector that projects a pattern of light, the projected pattern of light varying in intensity as a function of position and having a first, a second, and a third intensity; and

a detector having a first, a second, and a third detector element that each

generate an image value representing an amount of light in the imagable light signal from [the] an area of a scanned surface of the object, wherein the first detector element produces a first image value based on an image of the area of the scanned surface at the first intensity of the projected pattern of light, the second detector element produces a second image value based on an image of the area of the scanned surface at the second intensity, and the third detector element produces a third image value based on an image of the area of the scanned surface at the third intensity, and wherein the detector is maintained in a substantially fixed relation to the projected pattern of light.

57. [Amended Once] The system according to claim 56, further comprising

a drive that moves the object relative to the projector at the vision station so as to scan the projected pattern of light across a surface of the object to generate an imagable light signal.

58. The system according to claim 56, further comprising

a computational element coupled to the detector that computes the dimensional information associated with the object based on the first, second, and third image values.

59. The system according to claim 56, wherein the detector includes a tri-linear array.

60. [Amended Once] A method for high-speed scanning measurement of an object at a vision station, the vision station having a detector, in order to determine dimensional information associated with the object, the method comprising the steps of:

projecting a pattern of light, the projected pattern of light having a first, a second, and a third intensity at first, a second, and a third position, respectively;

maintaining the projected pattern of light and the detector in a substantially fixed relation to each other;

moving the object relative to the projected pattern of light so as to scan the projected

pattern of light across a surface of the object to generate an imagable light signal;

imaging the imagable light signal onto the detector, the detector having a first, a second, and a third detector element, wherein the area of the surface of the object is imaged onto the first detector element at the first intensity of the projected pattern of light, the area of the surface of the object is imaged onto the second detector element at the second intensity of the projected pattern of light, and the area of the surface of the object is imaged onto the third detector element at the third intensity of the projected pattern of light;

measuring with the detector an amount of light from the area of the surface of the object to the first detector element at the first intensity, to the second detector element at the second intensity, and to the third detector element at the third intensity; and

computing dimensional information based on the measuring step.

61. The method according to claim 60, wherein each one of the first, second, and third detector element includes a plurality of detector pixel elements.

62. The method according to claim 60, wherein the detector has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light includes a stripe of lines.

63. [Amended Once] The method according to claim 60, further comprising the step of determining a height of the area of the surface of the object based on phase and amplitude values from the measuring step.

64. The method according to claim 60, wherein a spacing between the first and second detector element is substantially equal to a corresponding spacing between the second and the third detector element, and wherein the step of moving is performed at a substantially uniform velocity.

65. The method according to claim 60, wherein the step of computing includes the step of registering the images.

66. The method according to claim 60, wherein the detector elements are elongated in a direction parallel to a detector axis of the detector, and wherein the detector also has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the detector axis and substantially perpendicular to the optical axis.

67. The method according to claim 66, wherein the detector includes a tri-linear array camera.

68. The method according to claim 60, wherein each detector element includes a row of CCD sensing elements extending substantially parallel to the detector axis and wherein the step of moving is performed in a direction substantially perpendicular to the rows of the CCD sensing elements.

69. [Amended Once] The method according to claim 60, wherein the step of projecting includes the step of projecting with two projected patterns of light.

70. The method according to claim 69, wherein the step of moving includes the step of cycling the object relative to the two projected patterns of light, and wherein the two projected patterns of light are alternately projected.

71. The method according to claim 69, wherein the two projected patterns of light are alternately projected during consecutive scans.

72. [Amended Once] A system for high-speed scanning measurement of an object at a vision station in order to determine dimensional information associated with the object, the system including:

a first projector that projects a pattern of light, the pattern of light having a first, a second, and a third intensity;

a drive that moves the object relative to the first projector at the vision station so as to scan the projected pattern of light across an area of a surface of the object to generate an object light signal;

a detector having a first, a second, and a third detector element that each generate an image value representing an amount of light in the object light signal from the area of the scanned surface of the object, wherein the first detector element produces a first image value based on an image of the area of the scanned surface at the first intensity of the projected pattern of light, the second detector element produces a second image value based on an image of the area of the scanned surface at the second intensity, and the third detector element produces a third image value based on an image of the area of the scanned surface at the third intensity, and wherein the detector is maintained in a substantially fixed relation to the first projector and the pattern of light; and

a computational element coupled to the detector that computes the dimensional information associated with the object based on the first, second, and third image values.

73. The system according to claim 72, wherein each detector element includes a plurality of detector pixel elements.

74. The system according to claim 72, wherein the detector has an optical element for receiving the object light signal, the optical element having an optical axis, and wherein the drive moves the object relative to the first projector in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light includes a stripe of lines.

75. [Amended Once] The system according to claim 72, wherein the computational element computes a height of the area of the surface of the object based on the first, second, and third image values.

76. The system according to claim 72, wherein the pattern of light is polarized and a response of the detector elements is polarization sensitive.

77. The system according to claim 72, wherein a spacing between the first and second detector element is substantially equal to a corresponding spacing between the second and the third detector element, and wherein the step of moving is performed at a substantially uniform velocity.

78. The system according to claim 72, wherein the computational element registers the images.

79. The system according to claim 72, wherein:

the detector elements are elongated in a direction parallel to a detector axis of the detector;

the detector also has an optical element having an optical axis; and

the drive moves the object relative to the first projector in a direction substantially perpendicular to the detector axis and substantially perpendicular to the optical axis.

80. The system according to claim 79, wherein the detector includes a tri-linear array camera.

81. The system according to claim 77, wherein:

each detector element includes a row of CCD sensing elements extending substantially parallel to the detector axis, and

the drive moves the object relative to the detector in a direction substantially perpendicular to the rows of the CCD sensing elements.

82. The system according to claim 72, further comprising a second projector, a second projector, the first and second projectors projecting the pattern of light.

83. The system according to claim 82, wherein the drive cycles the object relative to the two projectors wherein the two projectors alternately project the pattern of light during consecutive cycles.

84. The system according to claim 82, wherein the two projectors alternately project the pattern of light during consecutive scans of the projected pattern of light.

85. The system according to claim 72, wherein the projector and the detector define at least part of an optical head.

Appendix B - Clean Copy of the Claims Under Appeal

1. A method for high speed, scanning phase measuring of an object at a vision station to develop physical information associated with the object, the method comprising the steps of:

projecting a pattern of imagable electromagnetic radiation with at least one projector;

moving the object relative to the at least one projector at a substantially constant velocity at the vision station so as to scan the projected pattern of electromagnetic radiation across a surface of the object to generate an imagable electromagnetic radiation signal;

receiving the imagable electromagnetic radiation signal from the surface of the object with a detector having a plurality of separate detector elements which are substantially uniformly spaced;

maintaining the at least one projector and the pattern of imagable electromagnetic radiation and the detector in a substantially fixed relation to each other;

measuring an amount of radiant energy in the received electromagnetic radiation signal with the detector wherein each of the detector elements produce an image having a different phase of the same scanned surface based on the measurement; and

computing phase values and amplitude values for the different phases from the multiple images.

2. The method as claimed in claim 1 wherein the physical information is dimensional information and the imagable electromagnetic radiation is light.

3. The method as claimed in claim 2 wherein the detector has an optical axis and wherein the step of moving is performed in a direction substantially parallel to the optical axis and wherein the projected pattern of light is a stripe of lines.

4. The method as claimed in claim 2 further comprising the step of determining height of the surface of the object based on the phase and amplitude values.

5. The method as claimed in claim 1 wherein the physical information is polarization information, the imagable electromagnetic radiation is polarized, a response of the detector elements is polarization sensitive and wherein the images are based on polarization from the surface.

6. The method as claimed in claim 1 wherein the plurality of detector elements are uniformly spaced and wherein the step of moving is performed uniformly and continuously.

7. The method as claimed in claim 1 wherein the step of computing includes the step of registering the images.

8. The method as claimed in claim 1 wherein the detector elements are elongated in a direction parallel to a detector axis of the detector, and wherein the detector also has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the detector and optical axes.

9. The method as claimed in claim 8 wherein the detector is a multi-linear array camera.

10. The method as claimed in claim 8 wherein each detector element is a row of CCD sensing elements extending substantially parallel to the detector axis and wherein the step of moving is performed in a direction substantially perpendicular to the rows of the CCD sensing elements.

11. The method as claimed in claim 1 wherein the step of projecting is performed with two projectors.

12. The method as claimed in claim 11 wherein the step of moving includes the step of cycling the object relative to the two projectors wherein the two projectors alternately project the pattern of imagable electromagnetic radiation.

13. The method as claimed in claim 11 wherein the two projectors alternately project the pattern of imagable electromagnetic radiation during consecutive scans of the projected pattern of imagable electromagnetic radiation.

14. A system for high speed, scanning phase measuring of an object at a vision station to develop physical information associated with the object, the system including:

at least one projector for projecting a pattern of imagable electromagnetic radiation;

means for moving the object relative to the at least one projector at the vision station at a substantially constant velocity so as to scan the projected pattern of imagable electromagnetic radiation across a surface of the object to generate an imagable electromagnetic radiation signal;

a detector for receiving the imagable electromagnetic radiation signal from the surface of the object and having a plurality of separate detector elements which are substantially uniformly spaced for measuring an amount of radiant energy in the imagable electromagnetic radiation signal wherein each of the detector elements produces an image having a different phase of the same scanned surface based on the measurement;

means for maintaining the at least one projector and the pattern of imagable electromagnetic radiation and the detector in a substantially fixed relation to each other; and

means for computing phase values and amplitude values for the different phases from the images.

15. The system as claimed in claim 14 wherein the physical information is dimensional information and the imagable electromagnetic radiation is light.

16. The system as claimed in claim 15 wherein the detector has an optical component for receiving the reflected light signal, the optical component having an optical axis and wherein the means for moving moves the object relative to the at least one projector in a direction substantially parallel to the optical axis and wherein the projected pattern of light is a stripe of lines.

17. The system as claimed in claim 15 further comprising means for determining height of the surface of the object based on the phase and amplitude values.

18. The system as claimed in claim 14 wherein the physical information is polarization information, the imagable electromagnetic radiation is polarized, a response of the detector elements is polarization sensitive and wherein the images are based on polarization from the surface.

19. The system as claimed in claim 14 wherein the plurality of detector elements are uniformly spaced and wherein the means for moving moves the object relative to the at least one projector uniformly and continuously.

20. The system as claimed in claim 14 wherein the means for computing includes means for registering the images.

21. The system as claimed in claim 14 wherein the detector elements are elongated in a direction parallel to a detector axis of the detector and wherein the detector also has an optical component having an optical axis and wherein the means for moving moves the object relative to the at least one projector in a direction substantially perpendicular to the detector and optical axes.

22. The system as claimed in claim 21 wherein the detector is a multi-linear array camera.

23. The system as claimed in claim 21 wherein each detector element is a row of CCD sensing elements extending substantially parallel to the detector axis and wherein the means for moving moves the object relative to the detector in a direction substantially perpendicular to the rows of the CCD sensing elements.

24. The system as claimed in claim 14 further comprising two projectors, the two projectors projecting the pattern of imagable electromagnetic radiation.

25. The system as claimed in claim 24 wherein the means for moving cycles the object relative to the two projectors wherein the two projectors alternately project the pattern of imagable electromagnetic radiation during consecutive cycles.

26. The system as claimed in claim 24 wherein the two projectors alternately project the pattern of electromagnetic radiation during consecutive scans of the projected pattern of imagable electromagnetic radiation.

27. The system as claimed in claim 14 wherein the at least one projector and the detector at least partially define an optical head.

28. The method as claimed in claim 2 wherein the detector has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light is a stripe of lines.

29. The system as claimed in claim 15 wherein the detector has an optical component for receiving the reflected light signal, the optical component having an optical axis and wherein the means for moving moves the object relative to the at least one projector in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light is a stripe of lines.

30. A method for high-speed scanning measurement of an object at a vision station, the vision station having a detector, in order to determine dimensional information associated with the object, the method comprising the steps of:

projecting a pattern of light;

maintaining the projected pattern of light and the detector in a substantially fixed relation to each other;

moving the object relative to the projected pattern of light so as to scan the projected pattern of light across an area of a surface of the object to generate an imagable light signal;

imaging the imagable light signal onto the detector, the detector having a first, a second, and a third detector element, wherein the area of the surface of the object is imaged onto the first detector element at a first phase of the projected pattern of light, the area of the surface of the object is imaged onto the second detector element at a second phase of the projected pattern of light, and the area of the surface of the object is imaged onto the third detector element at a third phase of the projected pattern of light;

measuring with the detector an amount of light from the area of the surface of the object to the first detector element at the first phase, to the second detector element at the second phase, and to the third detector element at the third phase; and

computing dimensional information based on the measuring step.

31. The method according to claim 30, wherein each one of the first, second, and third detector element includes a plurality of detector pixel elements.

32. The method according to claim 30, wherein the detector has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light includes a stripe of lines.

33. The method according to claim 30, wherein the measurement step obtains an amplitude value at each one of the three phases, and further comprising the step of determining a height of the area of the surface of the object based on phase and amplitude values from the measuring step.

34. The method according to claim 30, wherein a spacing between the first and second

detector element is substantially equal to a corresponding spacing between the second and the third detector element, and wherein the step of moving is performed at a substantially uniform velocity.

35. The method according to claim 30, wherein the step of computing includes the step of registering the images.

36. The method according to claim 30, wherein the detector elements are elongated in a direction parallel to a detector axis of the detector, and wherein the detector also has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the detector axis and substantially perpendicular to the optical axis.

37. The method according to claim 36, wherein the detector includes a tri-linear array camera.

38. The method according to claim 30, wherein each detector element includes a row of CCD sensing elements extending substantially parallel to the detector axis and wherein the step of moving is performed in a direction substantially perpendicular to the rows of the CCD sensing elements.

39. The method according to claim 30, wherein the step of projecting includes the step of projecting with two projected patterns of light.

40. The method according to claim 39, wherein the step of moving includes the step of cycling the object relative to the two projected patterns of light, and wherein the two projected patterns of light are alternately projected.

41. The method according to claim 39, wherein the two projected patterns of light are alternately projected during consecutive scans.

42. A system for high-speed scanning measurement of an object at a vision station in order to determine dimensional information associated with the object, the system including:

a first projector that projects a pattern of light, the pattern of light having a first, a second, and a third phase;

a drive that moves the object relative to the first projector at the vision station so as to scan the projected pattern of light across an area of a surface of the object to generate an object light signal;

a detector having a first, a second, and a third detector element that each generate an image value representing an amount of light in the object light signal from the area of the scanned surface of the object, wherein the first detector element produces a first image value based on an image of the area of the scanned surface at the first phase of the projected pattern of light, the second detector element produces a second image value based on an image of the area of the scanned surface at the second phase, and the third detector element produces a third image value based on an image of the area of the scanned surface at the third phase, and wherein the detector is maintained in a substantially fixed relation to the first projector and to the pattern of light; and

a computational element coupled to the detector that computes the dimensional information associated with the object based on the first, second, and third image values.

43. The system according to claim 42, wherein each detector element includes a plurality of detector pixels elements.

44. The system according to claim 42, wherein the detector has an optical element for receiving the object light signal, the optical element having an optical axis, and wherein the drive moves the object relative to the first projector in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light includes a stripe of lines.

45. The system according to claim 42, wherein the computational element computes a height

of the area of the surface of the object based on the first, second, and third image values.

46. The system according to claim 42, wherein the pattern of light is polarized and a response of the detector elements is polarization sensitive.

47. The system according to claim 42, wherein a spacing between the first and second detector element is substantially equal to a corresponding spacing between the second and the third detector element, and wherein the step of moving is performed at a substantially uniform velocity.

48. The system according to claim 42, wherein the computational element registers the images.

49. The system according to claim 42, wherein:

the detector elements are elongated in a direction parallel to a detector axis of the detector;

the detector also has an optical element having an optical axis; and

the drive moves the object relative to the first projector in a direction substantially perpendicular to the detector axis and substantially perpendicular to the optical axis.

50. The system according to claim 49, wherein the detector includes a tri-linear array camera.

51. The system according to claim 42, wherein:

each detector element includes a row of CCD sensing elements extending substantially parallel to the detector axis, and

the drive moves the object relative to the detector in a direction substantially perpendicular to the rows of the CCD sensing elements.

52. The system according to claim 42, further comprising a second projector, the first and second projectors projecting the pattern of light.

53. The system according to claim 52, wherein the drive cycles the object relative to the two projectors wherein the two projectors alternately project the pattern of light during consecutive cycles.

54. The system according to claim 52, wherein the two projectors alternately project the pattern of light during consecutive scans of the projected pattern of light.

55. The system according to claim 42, wherein the projector and the detector define at least part of an optical head.

56. A system for high-speed scanning height measurement of an object at a vision station in order to determine dimensional information associated with the object, the system comprising:

an optical head, the optical head including:

a projector that projects a pattern of light, the projected pattern of light varying in intensity as a function of position and having a first, a second, and a third intensity; and

a detector having a first, a second, and a third detector element that each generate an image value representing an amount of light in the imagable light signal from an area of a scanned surface of the object, wherein the first detector element produces a first image value based on an image of the area of the scanned surface at the first intensity of the projected pattern of light, the second detector element produces a second image value based on an image of the area of the scanned surface at the second intensity, and the third detector element produces a third image value based on an image of the area of the scanned surface at the third intensity, and wherein the detector is maintained in a substantially fixed relation to

the projected pattern of light.

57. The system according to claim 56, further comprising

a drive that moves the object relative to the projector at the vision station so as to scan the projected pattern of light across a surface of the object to generate an imagable light signal.

58. The system according to claim 56, further comprising

a computational element coupled to the detector that computes the dimensional information associated with the object based on the first, second, and third image values.

59. The system according to claim 56, wherein the detector includes a tri-linear array.

60. A method for high-speed scanning measurement of an object at a vision station, the vision station having a detector, in order to determine dimensional information associated with the object, the method comprising the steps of:

projecting a pattern of light, the projected pattern of light having a first, a second, and a third intensity at first, a second, and a third position, respectively;

maintaining the projected pattern of light and the detector in a substantially fixed relation to each other;

moving the object relative to the projected pattern of light so as to scan the projected pattern of light across a surface of the object to generate an imagable light signal;

imaging the imagable light signal onto the detector, the detector having a first, a second, and a third detector element, wherein the area of the surface of the object is imaged onto the first detector element at the first intensity of the projected pattern of light, the area of the surface of the object is imaged onto the second detector element at the second intensity of the projected pattern of light, and the area of the surface of the object is imaged onto the third detector element at the third intensity of the projected pattern of light;

measuring with the detector an amount of light from the area of the surface of the object

to the first detector element at the first intensity, to the second detector element at the second intensity, and to the third detector element at the third intensity; and

computing dimensional information based on the measuring step.

61. The method according to claim 60, wherein each one of the first, second, and third detector element includes a plurality of detector pixel elements.

62. The method according to claim 60, wherein the detector has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light includes a stripe of lines.

63. The method according to claim 60, further comprising the step of determining a height of the area of the surface of the object based on phase and amplitude values from the measuring step.

64. The method according to claim 60, wherein a spacing between the first and second detector element is substantially equal to a corresponding spacing between the second and the third detector element, and wherein the step of moving is performed at a substantially uniform velocity.

65. The method according to claim 60, wherein the step of computing includes the step of registering the images.

66. The method according to claim 60, wherein the detector elements are elongated in a direction parallel to a detector axis of the detector, and wherein the detector also has an optical axis and wherein the step of moving is performed in a direction substantially perpendicular to the detector axis and substantially perpendicular to the optical axis.

67. The method according to claim 66, wherein the detector includes a tri-linear array camera.

68. The method according to claim 60, wherein each detector element includes a row of CCD sensing elements extending substantially parallel to the detector axis and wherein the step of moving is performed in a direction substantially perpendicular to the rows of the CCD sensing elements.

69. The method according to claim 60, wherein the step of projecting includes the step of projecting with two projected patterns of light.

70. The method according to claim 69, wherein the step of moving includes the step of cycling the object relative to the two projected patterns of light, and wherein the two projected patterns of light are alternately projected.

71. The method according to claim 69, wherein the two projected patterns of light are alternately projected during consecutive scans.

72. A system for high-speed scanning measurement of an object at a vision station in order to determine dimensional information associated with the object, the system including:

a first projector that projects a pattern of light, the pattern of light having a first, a second, and a third intensity;

a drive that moves the object relative to the first projector at the vision station so as to scan the projected pattern of light across an area of a surface of the object to generate an object light signal;

a detector having a first, a second, and a third detector element that each generate an image value representing an amount of light in the object light signal from the area of the scanned surface of the object, wherein the first detector element produces a first image value based on an image of the area of the scanned surface at the first intensity of the projected pattern

of light, the second detector element produces a second image value based on an image of the area of the scanned surface at the second intensity, and the third detector element produces a third image value based on an image of the area of the scanned surface at the third intensity, and wherein the detector is maintained in a substantially fixed relation to the first projector and the pattern of light; and

a computational element coupled to the detector that computes the dimensional information associated with the object based on the first, second, and third image values.

73. The system according to claim 72, wherein each detector element includes a plurality of detector pixel elements.

74. The system according to claim 72, wherein the detector has an optical element for receiving the object light signal, the optical element having an optical axis, and wherein the drive moves the object relative to the first projector in a direction substantially perpendicular to the optical axis and wherein the projected pattern of light includes a stripe of lines.

75. The system according to claim 72, wherein the computational element computes a height of the area of the surface of the object based on the first, second, and third image values.

76. The system according to claim 72, wherein the pattern of light is polarized and a response of the detector elements is polarization sensitive.

77. The system according to claim 72, wherein a spacing between the first and second detector element is substantially equal to a corresponding spacing between the second and the third detector element, and wherein the step of moving is performed at a substantially uniform velocity.

78. The system according to claim 72, wherein the computational element registers the

images.

79. The system according to claim 72, wherein:

the detector elements are elongated in a direction parallel to a detector axis of the detector;

the detector also has an optical element having an optical axis; and

the drive moves the object relative to the first projector in a direction substantially perpendicular to the detector axis and substantially perpendicular to the optical axis.

80. The system according to claim 79, wherein the detector includes a tri-linear array camera.

81. The system according to claim 77, wherein:

each detector element includes a row of CCD sensing elements extending substantially parallel to the detector axis, and

the drive moves the object relative to the detector in a direction substantially perpendicular to the rows of the CCD sensing elements.

82. The system according to claim 72, further comprising a second projector, a second projector, the first and second projectors projecting the pattern of light.

83. The system according to claim 82, wherein the drive cycles the object relative to the two projectors wherein the two projectors alternately project the pattern of light during consecutive cycles.

84. The system according to claim 82, wherein the two projectors alternately project the pattern of light during consecutive scans of the projected pattern of light.

85. The system according to claim 72, wherein the projector and the detector define at least

part of an optical head.